

CLAIMS

What is claimed is:

- 1 1. A pump assembly for circulating a supercritical fluid, comprising: an impeller for
2 pumping fluid between a pump inlet and a pump outlet; a rotating pump shaft coupled to
3 the impeller, wherein the pump shaft is supported by corrosion resistant bearings; a rotor
4 of a DC motor potted in epoxy and encased in a non-magnetic material sleeve; and a
5 stator sealed from the fluid via a polymer sleeve.

- 1 2. The pump assembly of claim 1, wherein the bearings are non-lubricated.

- 1 3. The pump assembly of claim 1, further including an electrical controller suitable for
2 operating the pump assembly, wherein the electrical controller comprises a commutation
3 controller for sequentially energizing windings of the stator.

- 1 4. The pump assembly of claim 1, wherein the pump is of centrifugal type.

- 1 5. The pump assembly of claim 1, wherein the bearings are made of silicon nitride balls
2 with bearing races made of Cronidur®.

- 1 6. The pump assembly of claim 1, wherein the bearings are one of following: ceramic
2 bearings, hybrid bearings, full complement bearings, foil journal bearings, or magnetic
3 bearings.

- 1 7. The pump assembly of claim 1, wherein the polymer sleeve is a PEEK™ sleeve.

- 1 8. The pump assembly of claim 1, wherein the non-magnetic material is stainless steel.

- 1 9. The pump assembly of claim 1, wherein the impeller has a diameter between 1 inch and 2
2 inches.
- 1 10. The pump assembly of claim 1, wherein the rotor has a diameter between 1.5 inches and
2 2 inches.
- 1 11. The pump assembly of claim 1, wherein the rotor has a maximum speed of 60,000 rpm.
- 1 12. The pump assembly of claim 1, wherein an operating pressure of the pump assembly is in
2 the range 1,500-3,000 psi.
- 1 13. The pump assembly of claim 1, wherein the supercritical fluid operates in the range 40-
2 100 degrees Celsius.
- 1 14. The pump assembly of claim 1, wherein the supercritical fluid is supercritical carbon
2 dioxide.
- 1 15. The pump assembly of claim 1, wherein the supercritical fluid is supercritical carbon
2 dioxide admixed with an additive or solvent.
- 1 16. The pump assembly of claim 1, wherein a portion of the supercritical fluid passes through
2 the pump assembly and then back to the pump inlet through an outer flow path, the outer
3 flow path including a filter to clean particles generated by a motor assembly.
- 1 17. The pump assembly of claim 1, wherein the motor is a variable speed motor.

- 1 18. The pump assembly of claim 1, wherein the motor is an induction motor.
- 1 19. The pump assembly of claim 1, wherein the non-magnetic material sleeve is welded to
2 the pump shaft such that torque is transferred through the non-magnetic material sleeve.
- 1 20. A pump assembly for circulating a supercritical fluid, comprising: an impeller for
2 pumping fluid between a pump inlet and a pump outlet; a rotating pump shaft coupled to
3 the impeller, wherein the pump shaft is supported by non-lubricated bearings; a rotor of a
4 DC motor potted in epoxy and encased in a stainless steel sleeve, the stainless steel sleeve
5 being welded to the pump shaft such that torque is transferred through the stainless steel
6 sleeve; and a stator sealed from the fluid via a PEEKTM sleeve, the rotor and the stator
7 defining an alternative flow path to divert a portion of the supercritical fluid through the
8 pump assembly and then back to the pump inlet through an outer flow path.
- 1 21. The pump assembly of claim 20, further including an electrical controller suitable for
2 operating the pump assembly, wherein the electrical controller comprises a commutation
3 controller for sequentially energizing windings of the stator.
- 1 22. The pump assembly of claim 20, wherein the pump is of centrifugal type.
- 1 23. The pump assembly of claim 20, wherein the impeller has a diameter between 1 inch and
2 2 inches.
- 1 24. The pump assembly of claim 20, wherein the rotor has a diameter between 1.5 inches and
2 2 inches.
- 1 25. The pump assembly of claim 20, wherein the rotor has a maximum speed of 60,000 rpm.

- 1 26. The pump assembly of claim 20, wherein an operating pressure of the pump assembly is
2 in the range 1,500-3,000 psi.
- 1 27. The pump assembly of claim 20, wherein the supercritical fluid operates in the range 40-
2 100 degrees Celsius.
- 1 28. The pump assembly of claim 20, wherein the supercritical fluid is supercritical carbon
2 dioxide.
- 1 29. The pump assembly of claim 20, wherein the supercritical fluid is supercritical carbon
2 dioxide admixed with an additive or solvent.
- 1 30. The pump assembly of claim 20, wherein the bearings can be made of silicon nitride balls
2 combined with bearing races made of Cronidur®.
- 1 31. The pump assembly of claim 20, wherein the bearings are one of following: ceramic
2 bearings, hybrid bearings, full complement bearings, foil journal bearings or magnetic
3 bearings.
- 1 32. The pump assembly of claim 20, wherein the motor is a variable speed motor.
- 1 33. The pump assembly of claim 20, wherein the motor is an induction motor.